



# Technology Demonstration and Infusion

International Planetary Probes Workshop (IPPW-8)  
Short Course

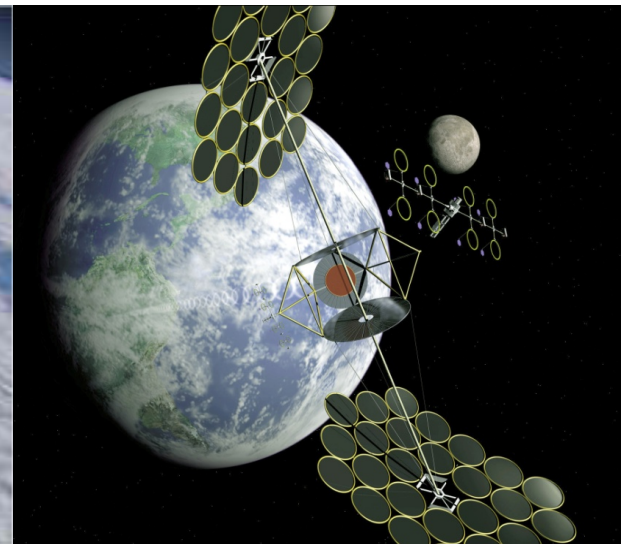
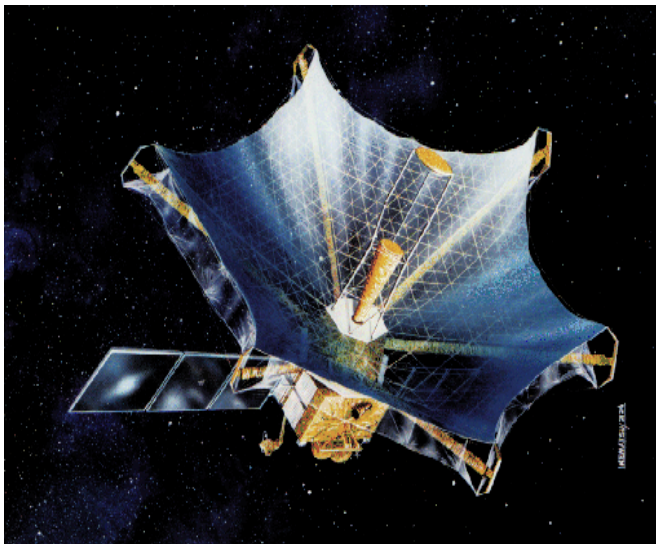
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# Technology Demonstration and Infusion

## Bridging the Gap

One of the greatest challenges that NASA faces in incorporating advanced technologies into future missions is bridging the gap between technology development and initial mission infusion.



# Technology Demonstration and Infusion

## Example – Ion Propulsion

### Bridging the Gap - Ion Propulsion Technology

**1906:** Robert Goddard theorizes about ion propulsion.  
Performs the first experiments with ion thrusters in 1916.

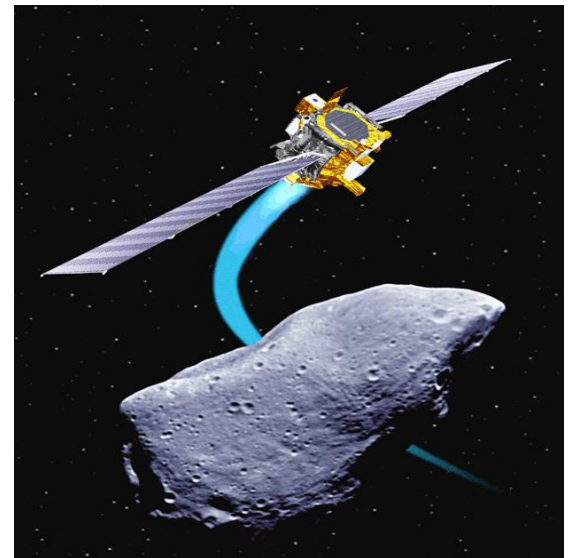
**1959:** A working ion thruster is built at NASA GRC.

**1960's through 1990's:** Many tests in the laboratory, but no mission uses the new technology as a primary propulsion system.

**1998:** The NASA New Millennium Program Deep Space 1 mission launches in 1998. DS1 is the first flight for NMP. DS1 was the first flight demonstration of an ion engine as the primary method of propulsion on a NASA spacecraft.

**2001:** NASA approves Dawn, as Discovery Program mission.

**2007:** Dawn launches. Dawn mission utilizes ion propulsion on journey to asteroid belt. Initially tested and proven successful on DS1 mission, this innovative technology is now applied for the first time in a dedicated science mission. Ion propulsion allows Dawn to undertake a mission that would be unaffordable—and even impossible—with a more conventional propulsion system.



# Technology Demonstration and Infusion

## Example – Aerobraking Technology

### Bridging the Gap – Aerobraking Technology

- Science fiction writers referencing aerobraking in the 1940's
- Many technical references to aerobraking in the 1960's, 70's, 80's

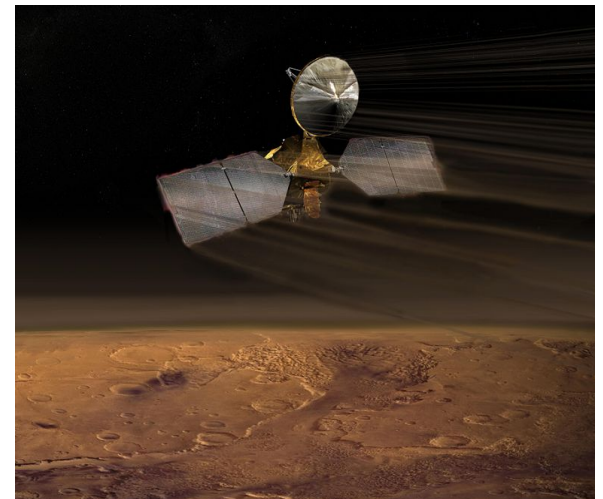
**1993:** NASA Magellan mission to Venus demonstrates aerobraking at the end of the primary science mission. The Magellan spacecraft at Venus was the first planetary spacecraft to try aerobraking, as a demonstration, in the summer of 1993. The success of this demonstration cleared the way for its implementation in the Mars Global Surveyor mission design.

**1994:** NASA decides to utilize aerobraking for the Mars Global Surveyor mission. Much like an airplane uses spoilers and flaps to slow down prior to landing, the MGS spacecraft uses the drag of the Martian atmosphere on its solar panels to slow down as an alternative to using thrusters which requires extra fuel and, therefore, extra weight and cost.

**1996:** MGS is launched, MGS orbiter is the first spacecraft to use aerobraking as the primary technique of orbit adjustment. The MGS aerobraking team used the data gathered from the Magellan mission to Venus.

**2001:** Mars Odyssey utilizes aerobraking.

**2005:** Mars Reconnaissance Orbiter utilizes aerobraking.



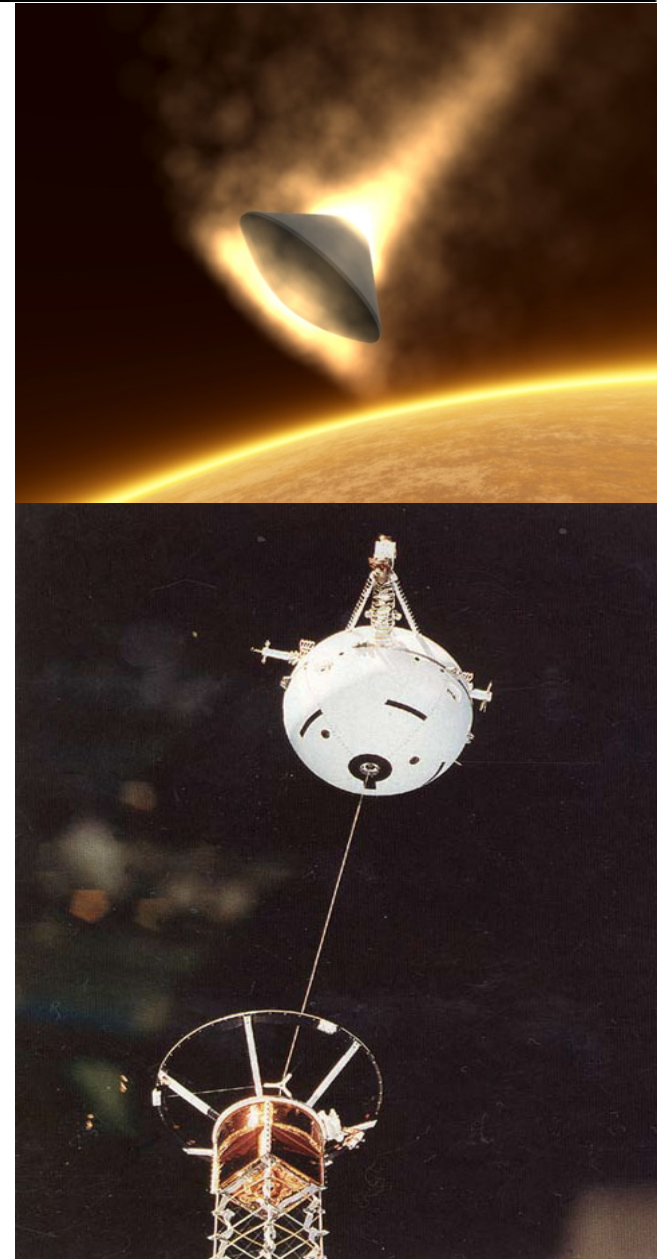


# Technology Demonstration and Infusion Challenges - Pitfalls

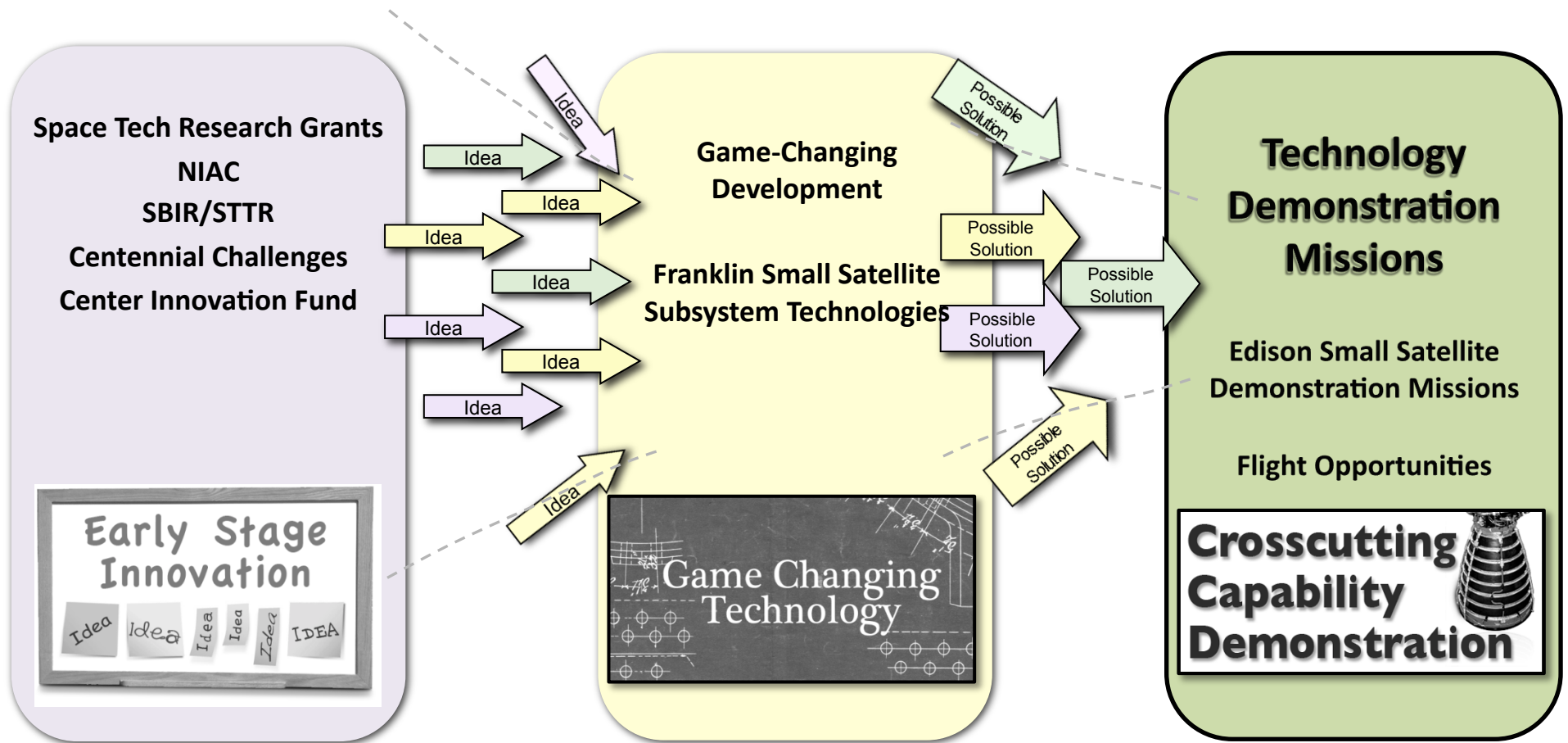
## Challenges in Bridging the Gap

### Pitfalls -Tech Demo/Mission Infusion

- Demonstration and development
- Mission specific technologies
- Demonstration takes too long
- Demonstration costs too much
- Space flight demonstration only
- Cost of access to space
- **Lack of infusion path**



# NASA Office of the Chief Technologist (OCT) Technology Demonstration Missions Program



□ Industry   □ Academia   □ Government



# OCT Technology Demonstration Missions (TDM) Program

## OCT Technology Demonstration Missions Program Addressing the Challenges and Pitfalls in Bridging the Gap

**Crosscutting**: Defined as a technology with potential to benefit multiple NASA mission directorates, other government agencies, academia, space industry.

**System-level**: Seeking system-level demonstrations, not component-level.

**Technology Readiness**: Must be mature technologies and the proposed flight demonstration must raise the Technology Readiness Level (TRL) of the candidate technology such that it may be infused into the critical path of future missions.

**Project Life Cycle**: Maximum of three year effort from award to flight readiness.

**Life Cycle Costs**: Typical project costs are \$10M to \$150M. Funding includes all elements of the flight test demonstration: planning, hardware development, software development, launch costs, ground ops, post test.

**Relevant Environment**: ground, air, suborbital or orbital regimes

**Access to Space**: OCT Flight Opportunities Prog, ISS, LSP, SMD/Wallops, DoD, Rideshare, SpaceX, Commercial Satellite Launch Providers

**Cost Sharing Partnerships**: To demonstrate a potential infusion path, teams will be required to have a sponsor(s) to cost share the demonstration. Contributions must be by another source outside the OCT. At least 25% of the total Life Cycle Cost is desired.

# OCT Technology Demonstration Missions Program

Request for Information (RFI) released last year  
200 responses

Broad Agency Announcement (BAA) released in March 2011  
90 Notices of Intent

BAA demonstration proposals due June 24, 2011

BAA award announcements in August 2011

